1. Name the type(s) of intermolecular forces that exist between molecules (or basic units) in each of the following species:
   a. LiF
   b. CH₄
   c. SO₂
   d. C₆H₆
   e. CH₃Cl
   f. PF₃
   g. NaCl
   h. CS₂

2. Which of the following species are capable of hydrogen bonding among themselves?
   a. H₂S
   b. C₆H₆
   c. CH₃OH
   d. C₂H₆
   e. HI
   f. BeH₂
   g. Br₂
   h. CH₃COOH

3. CH₃COOH Explain the term “polarizability.” What kind of molecules tend to have high polarizabilities? What is the relationship between polarizability and intermolecular forces?

4. Explain the difference between a temporary dipole moment and the permanent dipole moment.

5. What physical properties should you consider in comparing the strength of intermolecular forces in solids and in liquids?

6. Br₂ and ICl are binary molecules that have the same number of electrons, yet Br₂ melts at −7.2°C and ICl melts at 27.2°C. Explain.

7. Which of the following compounds is most likely to exist as a liquid at room temperature: ethane (C₂H₆), hydrazine (N₂H₄), fluoromethane (CH₃F)

8. Diethyl ether has a boiling point of 34.5°C, and 1-butanol has a boiling point of 117°C (shown below). Both of these compounds have the same numbers and types of atoms. Explain the difference in their boiling points.

9. Which substance in each of the following pairs would you expect to have the higher boiling point? Explain why.
   a. Ne or Xe
   b. CO₂ or CS₂
   c. CH₄ or Cl₂
   d. F₂ or LiF
   e. NH₃ or PH₃

10. What kind of attractive forces must be overcome in order to
   a. Melt ice
   b. Boil molecular bromine
   c. Melt solid iodine
   d. Dissociate F₂ into F atoms

11. If you lived in Alaska, which of the following natural gases would you keep in an outdoor storage tank in winter? Explain why. Methane (CH₄), propane (C₃H₈), or butane (C₄H₁₀)
12. Under the same conditions of temperature and density, which of the following gases would you expect to behave less ideally: CH₄, SO₂? Explain.

13. Assuming ideal behavior, calculate the density of gaseous HF at its normal boiling point (19.5°C). (use equation 5.11) The experimentally measured density under the same conditions is 3.10 g/L. Account for the discrepancy between your calculated value and the experimental result.